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None

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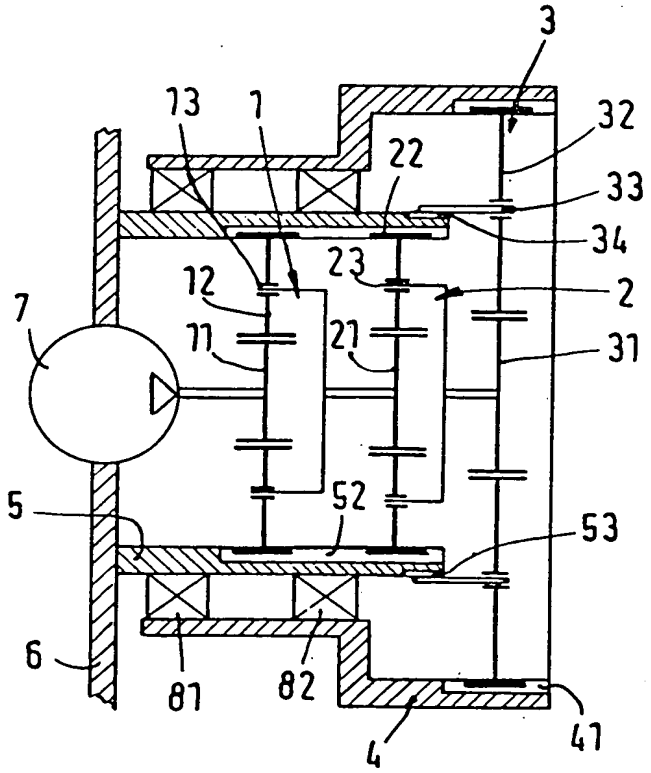
(54) Vehicle wheel reduction gear mechanism

(57) A reduction gear mechanism, in particular for tracked vehicles, has a planetary gear between a hollow wheel (4) and a drive unit (7), which is partially arranged in a jacket or sleeve (5) attached to the vehicle housing (6), on which the hollow wheel (4) is rotatably supported.

At least one planetary gear (1,2) is arranged in the sleeve (5) and the ring gear therefor is integral with the sleeve. The output from this gear or gears is coupled to a further planetary gear (3) of which the planet wheel carrier (33) is fixed relative to the sleeve (5).

Fig.1



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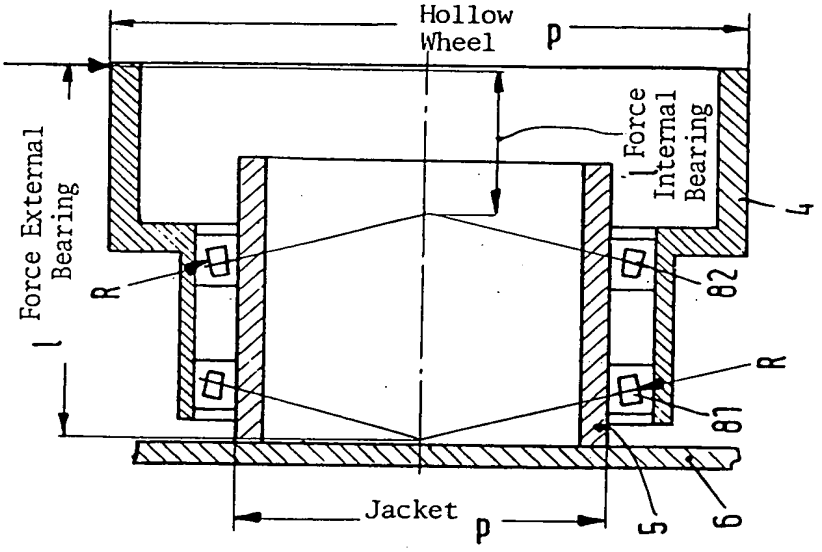

Fig.2

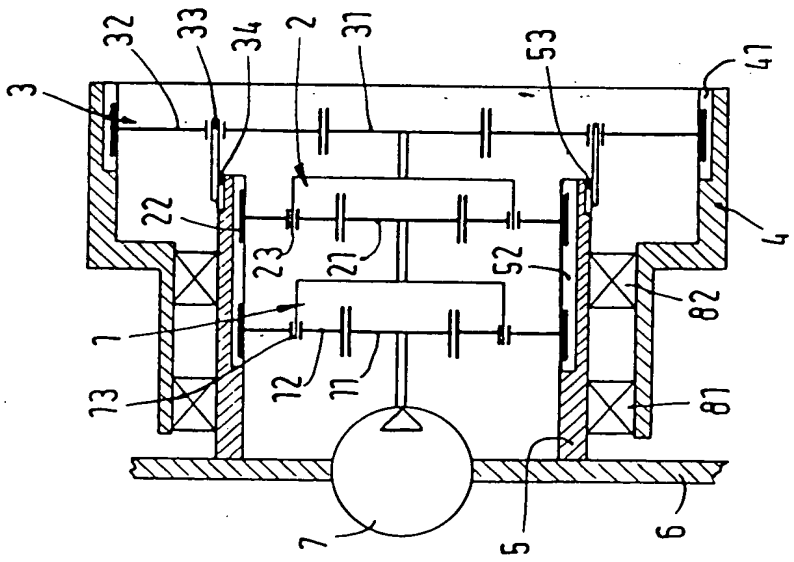

Fig.1

SPECIFICATION

Wheel reduction gear

The invention relates to a wheel reduction gear, particularly for tracked vehicles, with a planetary gear between a hollow wheel and a drive unit, which is partially arranged in a jacket or sleeve attached to the vehicle housing. The hollow wheel is typically supported externally by means of two bearings on the sleeve.

German published Application No. 30 15 818 discloses an hydrostatic vehicle gear in which the hollow wheel is supported via two bearings on a jacket which is attached to the vehicle, on the head piece of which planet wheel carriers are arranged. The planetary gear steps are incorporated in the hollow wheel outside the jacket and the planet wheel sets mesh on the outside with the internal toothing of the hollow wheel. The gear elements are thereby only protected by the hollow wheel and are therefore sooner at risk from damage from the outside.

The arrangement of the first planet step on the side opposite the drive has a disadvantageous effect. This relates on the one hand to the length of the drive shaft and on the other hand to the hollow shaft between the crosspiece of the first step to the sum wheel of the second step. The provision of internal toothings on the hollow wheel, with various diameters, necessitates high production costs.

Further in connection with the above, because of the relatively small internal diameter of the jacket or sleeve which is attached to the vehicle, only a small part of the driving motor is situated inside the jacket, whereas the other part projects in an obstructing manner into the vehicle space.

The present invention is directed at the problem of creating a sturdy and powerful wheel gear with high reduction which is protected from damage from the outside, in particular from undesired tilting effects. According to the invention a reduction gear mechanism is provided for use between an hollow wheel rotatably mounted on a sleeve attached to a body, which mechanism comprises at least one epicyclic gear mounted in the sleeve with the ring gear of said epicyclic gear integral with the sleeve, the output coupled to a further epicyclic gear of which the planet wheel carrier is fixed relative to the sleeve, and of which the planet wheels transmit drive to the hollow wheel. The planet wheel carrier of the further gear is preferably fixed relative to the sleeve by means of an internally toothed gear meshing with teeth on the external surface of the sleeve.

The wheel is typically rotatably mounted on the sleeve by means of two spaced bearings on the sleeve, one adjacent the base thereof and the other proximate the ring gear of said at least one epicyclic gear. The bearings are preferably in an O-arrangement, the bearing axes being inclined to define a pair of frustocones facing axially away from one another. Tapered roller bearings are preferred. In a particularly preferred embodiment, tapered rollers of adjacent bearings are arranged with respect to each other such that with a ratio of the external diameters of the wheel and sleeve in the range 1.5 to 1.8, the ratio of the intervals of the point of intersection of the force acting on the hollow wheel at the end of the sleeve with the gear centre axis to the points of intersection of the resulting resultant forces acting vertically onto the roller axes is in the range 0.50 to 0.55.

According to the invention the jacket or sleeve which is attached to the vehicle housing holds parts of the drive and two planetary gear steps, which are thereby accommodated so as to be protected in the fixed part of the wheel reduction gear. The relatively large jacket is rigid, so that undesired deformations have little, if any effect on the planetary gear. The simple shape of the jacket is economic in terms of manufacturing technique and cost. At the head of the jacket, advantageously, the planet wheel carrier for the further epicyclic or output drive gear may be mounted.

The length and the diameter of the jacket have the additional advantage when tapered-roller bearings are used to mount the hollow wheel, as such bearings have a broad supporting base. The lines of the resultant forces resulting from the outer forces and leading through the roller axes, form an "O", the width of which is dependent amongst other considerations, on the diameter of the jacket. A broad supporting base causes tilting forces, which occur particularly frequently, without acting on the planetary gear, to be transferred to the vehicle housing via the bearing system and via the jacket. Damage to the planetary gear is thereby largely prevented.

The series connection of the epicyclic gears has the advantage that the flux of force is directed from the drive to the hollow wheel over a short distance without reversal. For this, simple and sturdy structural components come into use.

The wheel gear is designed with a high reduction i, which extends up to an $i = 220$. This high reduction i allows driving to take place slowly and allows a high performance to be utilized economically.

The invention will now be described by way of example and with reference to the accompanying drawing wherein:

Figure 1 is a diagrammatic illustration of the gear; and

Figure 2 shows the "O" arrangement of the tapered roller bearing.

As shown in Fig. 1 the bearings 81 and 82 are arranged between the hollow wheel 4 and the jacket 5, so that the hollow wheel 4 can

rotate about the jacket which is attached to the vehicle housing 6. In the jacket 5, the internal toothing 52 and the external toothing 53 are worked in at the head.

The hydraulic driving motor 7 drives the sun wheel 11 of the planetary gear 1 via a short shaft. The planet wheels 12 mesh with the sun wheel 11 and the internal toothing 52 and drive the planet wheel carrier 13. The planet wheel carrier 13 is connected via a shaft with the sun wheel 21 of the planetary gearing 2. The planet wheels 22 mesh with the sun wheel 21 and the internal toothing 52 and drive the planet wheel carrier 23, which in turn is connected with the sun wheel 31 of the planetary gear 3.

The internal toothing 34 of the planet wheel carrier 33 engages into the external toothing 53 of the jacket 5 and is fixed there. The sun wheel 31 drives the hollow wheel 4 via the planet wheels 32 which are rotatably mounted on the fixed planet wheel carrier 33. The planet wheels 32 thereby mesh with the internal toothing 41.

Fig. 2 shows a force P acting at the head end of hollow wheel and the resultants R of the forces acting on the bearings 81 and 82. The points of intersection of the resultant forces, resulting from the external forces and carried through the roller axes with the geometric axis of the drive shafts lie as far apart from each other as possible.

CLAIMS

1. A reduction gear mechanism for use between a hollow wheel rotatably mounted on a sleeve attached to a body, which mechanism comprises at least one epicyclic gear mounted in the sleeve with the ring gear of said epicyclic gear integral with the sleeve, the output therefrom being coupled to a further epicyclic gear of which the planet wheel carrier is fixed relative to the sleeve, and of which the planet wheels transmit drive to the hollow wheel.

2. A reduction gear mechanism according to Claim 1 wherein the planet wheel carrier of said further epicyclic gear includes an internally toothed gear meshing with teeth on the external surface of the sleeve.

3. A reduction gear mechanism according to Claim 1 or Claim 2 wherein the coupling between said at least one epicyclic gear and the further gear is a link between the planet wheel carrier of a said epicyclic gear and the sun wheel of the further gear.

4. A reduction gear mechanism according to any preceding Claim including two said epicyclic gears mounted in the sleeve with the planet wheels of both meshing with a common ring gear integral with the sleeve, the gears being coupled by a link between the planet wheel carrier of one and the sun wheel of the other.

5. A reduction gear mechanism according to any preceding Claim having an overall gear ratio of no more than 1:220.

6. A reduction gear mechanism according to any preceding Claim including a drive unit extending into the base of the sleeve and coupled to the sun wheel of said at least one epicyclic gear therein.

7. A reduction gear mechanism according to any preceding Claim wherein the wheel is rotatably mounted on the sleeve by means of two spaced bearings on the sleeve, one adjacent the base thereof and the other proximate the ring gear of said at least one epicyclic gear.

8. A reduction gear mechanism according to Claim 7 wherein the bearings are in an O-arrangement, the bearing axes being inclined to define a pair of frusto-cones facing axially away from one another.

9. A reduction gear mechanism according to Claim 7 or Claim 8 wherein the bearings are tapered roller bearings.

10. A wheel reduction gear according to Claim 9 wherein the tapered rollers of adjacent bearings are arranged with respect to each other such that with a ratio of the external diameters of the wheel and sleeve in the range 1.5 to 1.8, the ratio of the intervals of the point of intersection of the force acting on the hollow wheel at the end of the sleeve with the gear centre axis to the points of intersection of the resulting resultant forces acting vertically onto the roller axes is in the range 0.50 to 0.55.

11. A wheel reduction gear substantially as described herein with reference to the accompanying drawing.

12. A vehicle incorporating a reduction gear according to any preceding Claim between a power unit and a drive wheel thereof.

13. A tracked vehicle according to Claim 12.

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